Worklessness and regional differences in the social gradient in general health: Evidence from the 2001 English Census.

ABSTRACT

Background: There has been much focus on separating contextual and compositional influences on social inequalities in health. However, there has been less focus on the important role of place in shaping the distribution of risk factors. Spatial variations in worklessness are one such factor. In this paper then we examine the extent to which between and within regional differences in the social gradient in self-rated general health are associated with differences in rates of worklessness.

Methods: Data were obtained for men and women of working age (25-59) who had ever worked from the Sample of Anonymised Records (Individual SAR) - a 3% representative sample of the 2001 English Census (349,699 women and 349,181 men). Generalised linear models were used to calculate region and age adjusted prevalence difference for *not good health* by education (as an indicator of socio-economic status) and employment status. The slope index of inequality was also calculated for each region.

Results: For both men and women, educational inequalities in worklessness and *not good health* are largest in those regions with the highest overall levels of worklessness. Adjusting for worklessness considerably attenuated the educational health gradient within all English regions (by over 60%) and virtually eliminated between region differences.

Discussion: Macroeconomic policies which influence the demand for labour may have an important role in creating inequalities in general health of the working age population both within and between regions. Employment policy may therefore be one important approach to tackling spatial and socio-economic health inequalities.

Abstract: 246 words; Manuscript word count: 4689 (including references)

Keywords: worklessness, employment, Census, health inequalities, regions, education.

BACKGROUND

Worklessness is an important determinant of health with unemployment and other forms of economic inactivity (such as lone parenthood or long term sickness absence) being associated with an increased likelihood of morbidity and mortality (Bartley, 1994; Morris et al, 1994; Martikainen and Valkonen, 1996; Korpi, 2001; Rodriguez, 2001; Bartley and Plewis, 2002; Bartley et al, 2006). There is, for example, a well established literature on the individual and area level relationship between unemployment and increased risk of poor mental health and parasuicide, higher rates of all cause mortality, self reported health and limiting long term illness, and, in some studies, a higher prevalence of risky health behaviours (amongst young men), including problematic alcohol use and smoking (Bartley et al, 2006). Research has also drawn attention to the contributory role of ill health itself as a factor behind worklessness (Jusot et al, 2008), not least in the form of long term sickness absence (Beatty and Fothergill, 2002; Bambra and Norman, 2006; Norman and Bambra, 2007; MacKay and Davies, 2007). Ill health related job loss has a social gradient, with adverse employment consequences more likely for those in lower socio-economic (i.e. lower educated) groups (Bartley and Owen, 1996). Worklessness is associated with poverty and social exclusion, and it tends to be concentrated in lower socio-economic groups (Arber, 1987; Rodriguez, 2001). Worklessness is therefore a very important social determinant and in a recent paper, we demonstrated its contribution to the overall social gradient in health (Popham and Bambra, 2010). We found that prevalence differences by education in the 2001 English Census of *not good health* were reduced by 50% or over when adjusting for employment status (Popham and Bambra, 2010). However, no study has yet examined the contribution of regional differences in the rates of worklessness to regional differences in socio-economic health inequalities.

Similarly, while there has been much recent focus in health geography on separating contextual and compositional influences on social inequalities in health there has been less focus on the important role of place in shaping the distribution of risk factors (Tunstall et al, 2004). One clear example is the regional variation in employment rates in England associated with the lasting effects of de-industrialisation (Erdem and Glyn, 2001). In the latter part of the 20th century, there were regionally concentrated falls in the demand for labour (most notably in

the North East, North West and Wales), particularly affecting those with less education (Nickell and Quintini, 2002). These regional differences have led to large spatial and socio-economic variations in employment rates which may be further exacerbated by the recent economic recession (Fothergill, 2001; Mackay and Davies, 2007; Nickell and Quintini, 2002). These trends are seen for both men and women, despite an overall expansion of employment for women in the last 30 years (Nickell and Quintini, 2002). In the long term, this socially and spatially stratified lack of demand for labour has not expressed itself in terms of higher rates of unemployment but instead as structural worklessness - particularly sickness and incapacity related economic inactivity (Beatty and Fothergil, 2005; Fothergill, 2001; Mackay and Davies, 2007; Nickell and Quintini, 2002).

Previous research has shown that the highest levels of working age morbidity and mortality are concentrated in the same regions and socio-economic groups most affected by this reduced demand for labour (Doran et al, 2004; Woods et al, 2005). Therefore, we hypothesise that the increased risk of worklessness may play an important role in both spatial (regional) and socio-economic (educational) inequalities in general health. This study examines whether between and within regional differences in the educational social gradient in self-rated general health are associated with differences in rates of worklessness. Specifically, using data on self-rated health from the 2001 English Census, this study addresses two inter-related questions:

1. To what extent are educational inequalities in health within regions of England attenuated after accounting for variations in employment status?
2. Are differences between regions in their educational gradient in health changed by accounting for employment status?

METHODS

Data and variables

The dataset used in this study is the Individual Sample of Anonymised Records (Individual SAR) a 3% sample of the 2001 UK Census. The Samples of Anonymised Records scheme provides researchers with access to completely anonymised Census data to allow detailed

micro level analysis. The Individual SAR was chosen for this study as it contained sufficiently detailed coding on employment status and socio-economic position. Full details on the Samples of Anonymised Records and the Individual SAR have been published (Cathy Marsh Centre for Census and Survey Research, 2007). The 2001 English Census aimed to cover the whole population (i.e. 100%) through Census returns (estimated response rate of 94%) and imputation of missing individuals based on further enumeration by a detailed and extensive post Census face to face survey. Imputation was also used in cases of missing answers (Cathy Marsh Centre for Census and Survey Research, 2007). We limited our analysis to people of working age (25 to 59) and additionally excluded full time students and those living in communal residences (e.g. hospitals). The working age population was restricted to those aged 25-59 for the following reasons: 1) as we also excluded full time students, the remaining under 25 age group would be very selective; 2) it was limited to 59 years old because the data is from 2001 when the state pension age for women in England was still 60 and we wanted male and female data to be comparable; 3) the 59 years cut off also reflects the Census age bands (i.e. 44-59). We also excluded the 1.3% of men and 3.9% of women who had never worked. The final sample sizes were thus 349,699 women and 349,181 men.

The Census form is available online (http://www.statistics.gov.uk/Census2001/pdfs/H1.pdf). Self-rated general health was assessed in the Census, for the first time in 2001, by the following question “Over the last twelve months would you say your health has on the whole been … Good? Fairly good? Not good?” Following others we dichotomised responses to compare people reporting “not good” health to those reporting “good or fairly good” health (Doran et al, 2004). Self-rated general health was a new question on the 2001 Census and was chosen in preference to the existing question on limiting illness as it did not include in its definition limitations to work and thus is independent in definition from employment status. The question was asked on the Census form before a question on having a limiting illness and before questions on employment status.

Employment status was derived in the Census through a number of questions and was coded as follows: employed, unemployed (that is not in employment but actively seeking

employment) and the following categories of economic inactivity (not in employment and not actively seeking employment), retired, looking after home / family, permanently sick or disabled, and other economically inactive (including part-time students and people not regarding themselves as being in the other categories of economic inactivity).

Socio-economic position is a multifaceted construct (Galobardes et al, 2006). We focus on education as our marker of socio-economic position as it is both important for future employment and also reflects socio-economic background (Breen and Jonsson, 2005; Jackson et al, 2005). As most people achieve their highest qualifications by their early 20s, it is also unlikely to be influenced by adult employment or health situation (Kreiger et al, 1997). In the 2001 Census, education was based on the level of the highest qualification and having a professional qualification and was coded using standard Census categories: No qualifications, other qualifications (not covered in the following categories), level 1 (minimal end of compulsory schooling qualifications - age 16), level 2 (end of compulsory schooling qualifications or minimal end of post compulsory schooling qualifications or vocational equivalent – age 18), level 3 (post compulsory schooling qualifications or vocational equivalent qualifications), level 4/5 (higher education degree or vocational equivalent or professional qualification (e.g. doctor, teacher, nurse).

In England, there are nine regions (see Box 1 for descriptions of the regions). These all have Government Offices which are administratively and economically important in terms of having some devolved responsibility for the local economy including the allocation of regional development funds, drawing up regional economic strategies, and encouraging inward regional investment (including the receipt of European Union funding). One of the main tasks of regional Government Offices are “to strengthen the economy in every region, working to reduce the gap in economic growth rates between the regions” (Government Offices, 2010). Regional public health groups and Strategic Health Authorities also exist at a regional level and some public health interventions are regionally operated and coordinated. Further information on the role of the English regions is available at: http://www.gos.gov.uk/national/.

As the most prosperous and "healthy" region in England is the South East (Doran et al, 2004), we use this as the reference region when applicable.

Finally, age was available in the individual SAR dataset in the following banded categories: 25 to 29, 30 to 44 and 45 to 59.

Analysis

As men and women vary in employment patterns we conducted separate analysis for each. To obtain age standardised rates of employment and *not good health* by education and region we used direct standardisation using the overall sex specific population as the reference. To describe the educational gradient in the prevalence of *not good health* within each region we calculated the slope index of inequality. The slope index of inequality summaries in a single measure the difference in the rate of health across an ordered categorical variable (in this case education) taking account of the rate in all categories and the percentage of people in each category. This means that the gradient can be compared between regions (in our case) in which levels of education may vary. To calculate the slope index of inequality each category of the education variable was coded between 0 and 1. The exact value assigned to each category of education was at its mid-point on the cumulative distribution of the categories within the region (Mackenbach and Kunst, 1997). So for example, if the highest education category included 20% of the region's population then this would be coded 0.1 (0.2/2), and if the next highest category included 30% then this would be coded 0.35 (0.2+0.3/2) and so on. This variable was then entered into a regression model as a continuous covariate with health as the outcome and with additional adjustment for age. The coefficient of the continuous education covariate is the slope index of inequality and can be interpreted as the difference in prevalence across the educational categories (the gradient) from the (theoretical) highest (0) educated to the (theorectical) lowest educated (1) (Mackenbach and Kunst, 1997).

We fitted models using linear regression and robust standard errors as this is a validated method for obtaining prevalence differences in binary health variables (Cheung, 2007).

To assess the impact of employment status on the education gradient we then added the employment status variable to the models and calculated the percentage reduction in the

education gradient (the slope index of inequality) using the formula (prevalence difference in age adjusted model – prevalence difference in age and employment adjusted model) / (prevalence difference in age adjusted model). Where initial age adjusted prevalence difference was negative (lower than the reference category) we did not calculate the percentage reduction.

To make a direct test of how the education gradient varied between regions, we combined the separate regional regressions using seemingly unrelated estimation. This is a method of combining separate regression models so that the same coefficient in each model (in our case the education gradient) can be compared. Having combined the separate regressions we then tested the difference in each region's gradient compared to the South East's, for both the age and age and employment adjusted models.

In sensitivity analysis we refitted the models treating education categorically with the highest (level 4/5) as the reference category. .Additionally, we split the sample into two to compare inequalities for those aged 25 to 44 and 45 to 59. Stata 10.1 was used for all analysis.

RESULTS

Overall 85.7% of men and 73.2% of women were employed in 2001 with regions of the north and London having the lowest levels (Table 1). There were also variations in employment by educational level within each region as illustrated in Figures 1 and 2 (with the age adjusted rates used given in supplemental Table 1). For both men and women employment rates decline with lower education but differences are largest in those regions with the lowest levels of employment. For example the overall age adjusted rate of male employment in the prosperous South East was 89.9% while in the North East it was just over ten points lower at 79.2%. However, for men with level 4/5 qualifications the rates were 93.2% and 90.9% in the South East and North East respectively but for men with no educational qualifications rates were 80.8% and 62.7% respectively.

Rates of *not good health* were higher amongst non-employed groups for both men and women in all regions (Table 2). For example, amongst men in the South East, differences in the prevalence of *not good health* were 6.6 (5.2 - 8.0) for the unemployed, 8.0 (5.9 – 10.1) for the

retired, 5.7 (3.2 – 8.2) for those looking after the home, 66.5 (64.4 – 68.6) amongst the permanently sick, and 18.6 (16.1 to 21.1) for the other category. In terms of *not good health* by region and education, (Table 1, Figures 3 and 4 and supplemental table 2) differences in the prevalence between regions tends to increase for those with lower education. In the South East the age adjusted gradient in *not good health* for men represented by the slope index of inequality (see Table 3) was an 8 percentage point difference between the highest and lowest educated. The gradient was significantly steeper in all other regions apart from the East of England and the South West. For example in the North East it was 17.4 percentage points. For women the patterns were similar although gradients less steep (see Table 4).

After additional adjustment for employment status the gradient was substantially reduced by over 60% in all regions. Regional gradients also became similar with only London still having a significantly larger gradient than the South East for men and women. While the North East's gradient was actually smaller than the South East's for women. Supplemental tables 4 and 5 show the prevalence differences in health for men and women by individual category of education (compared to levels 4/5) within regions.

Table 5 shows the sensitivity analysis in which the slope index of inequality in education for men and women was split between those aged under 45 and those aged 45 and above. For the oldest age group the slope indexes of inequality were large before adjustment for employment status and varied by region with low employment regions having the highest levels of inequality, regional differences and the actual slopes were attenuated by adjustment for employment status as seen in the overall results. For under 45s the slope indexes of inequality were less, with regional variations more apparent for men than women, again adjustment for employment status attenuated the slope index and regional inequalities, although London still had higher inequalities than the South East after adjustment.

DISCUSSION

In summary, the results suggest that for both men and women differences in levels of worklessness play a significant role in educational inequalities in self-rated general health and

in differences in the educational gradient between the regions of England. This extends the work of Arber (1987) who suggested an important role for employment status in understanding health inequalities in general health. It also extends previous work on inequalities in general health using the 2001 UK census that showed similar regional patterns, using relative risks, but did not consider the impact of employment status (Doran et al, 2004). Similarly, our age specific analysis revealed that regional differences and their attenuation by employment were not simply limited to the oldest age group. While there was some positive signs for regional differences in female health amongst the 25 to 44 year olds, educational differences were still apparent and regional differences associated with employment still apparent even for the youngest men. This is worrying as it suggests a persistence of regional health inequalities in the future (Erdem and Glyn, 2001). Regional health inequalities are therefore likely to continue into the future then unless the unequal levels of worklessness and economic development are tackled. The economic recession which began in 2008 may also further exacerbate the trends we have noted.

Of course whether worklessness causes poor health per se is subject to continuing debate with some commentators arguing that health selection could be an important factor (Martikainen et al, 2007). Probably the best longitudinal evidence in regards to self reported health and its relationship with employment status within the UK comes from longitudinal studies of the British Household Panel Survey (Bartley et al, 2004; Sacker et al, 2007; Thomas et al, 2005). These studies have shown that recovery from poor mental health (Thomas et al, 2005), limiting illness (Bartley et al, 2004) and general health are associated with returning to employment (Sacker et al, 2007) and that deterioration in health is associated with periods of worklessness regardless of socio-economic circumstances. So there is strong evidence of a causal link between employment and self-rated health although further quasi experimental work is needed (Oswald, 2007). Our results are therefore suggestive of a possibly very important role for employment policy in socio-economic and spatial health inequalities.

Our results therefore have some important implications for the direction of public policy and for the strategies required to substantially reduce socio-economic and spatial health inequalities.

Firstly, our results have once more highlighted the universal experience of poorer self reported health amongst the unemployed and economically inactive of all socio-economic groups and across all regions. This is in keeping with previous studies of the health of the unemployed which have found that, across a diversity of health indicators, employment is better for health than unemployment (for an overview see Bartley et al, 2006). Public policy has an important influence on the social, economic and health consequences of the lack of employment as benefit rates can be raised to prevent material deprivation, and resources and services can be made available to enhance social inclusion (Bartley and Blane, 1997). Indeed a comparative international study has shown that the health of the unemployed and economically inactive is improved by higher rates of state benefits (Rodriguez, 2001). Secondly, our results have reinforced the importance of worklessness to the social gradient in health (Arber 1987; Popham and Bambra, 2010). This suggests that policies to reduce health inequalities, not just between the most affluent and the poorest, but across the whole social gradient may need to focus on increasing the proportion of people in paid employment. This translates as not just the need to get people into work or to help people maintain employment in times of adversity (such as ill health), but also an increase in the demand for labour particularly in regions and areas still suffering from the consequences of de-industrialisation (Coombes and Raybould, 2004). Finally, and most importantly, our finding that educational differences in *not good health* were largest in regions with the lowest levels of employment and that adjusting for individual employment status attenuated both the regional variation in health inequalities suggests an important role for regional employment policy in spatial differences in health inequalities. Macroeconomic change and public policy responses to it are therefore very important for understanding spatial variations in health inequalities within countries.

Strengths and limitations

In our analysis we made efforts to minimise health selection (present health state causing non-employment rather than vice versa) by limiting analysis to only those who had ever worked. Using education as our measure of socio-economic position also gave some protection against present health changing socio-economic position. However it is important to recognise that our

analysis is cross-sectional and that present health could lead to a loss of employment. We would argue that our regional analysis also offers some protection from health selection as it is unlikely that the different rates of employment in the regions would be purely as a result of different levels of health selection. Selective migration away from low employment regions may also have influenced our results, however evidence suggests that regional migration rates in the UK are low and much more common amongst higher rather than lower socio-economic groups (McCormick, 1997). Also it has been found that at the regional level migration has little impact on health inequalities (Brimblecombe et al, 1999). Another limitation is our use of the nine English Government Office Regions as the spatial unit of analysis the results of our analysis may differ if a lower geographical level (such as Local Authority Districts) had been used. Strengths include the large sample size, the representativeness of census data, the use of a general health question independent in definition to work and the focus on absolute levels of health.

CONCLUSION

Health geography has focused on separating contextual and compositional influences on social inequalities in health. However, there has been less focus on the important role of place in shaping the distribution of risk factors (Tunstall et al, 2004). This paper is the first to examine regional variation in employment rates in England as an example of the role of place in shaping the distribution of social risks to health and of the social gradient in health. We have found that worklessness is a very important determinant of the social gradient in self-rated health within the regions of England and in differences in the size of health inequalities between the English regions. Our analysis leads us to conclude that differences in regional employment rates account for why health inequalities are worse in some regions (such as the North East) than others (specifically the South East). This underscores the important role of place in shaping the distribution of risk factors for poor health. Our study also highlights the importance of macroeconomic change and public policy responses to it in terms of structuring spatial and socioeconomic health inequalities.

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Box 1: UK Government Regional Development Agency descriptions of each English region (Regional Development Agency, 2010)

The South East is regarded as one of the most successful of England's regions, regularly achieving high growth rates, high economic activity rates and low unemployment. It is the 22nd largest economy in the world. The South East economy is advanced, high income, broadly based and service oriented. (Population size 2001 census = 8,000,645; Number in this study = 115,868)

The North East has suffered from sustained economic decline as industries such as coal mining and ship building have virtually disappeared. It has the highest proportion of workless households and deprivation in any UK region. (Population size 2001 census = 2,515,442; Number in this study = 35,663)

The Northwest regional economy went through a major period of restructuring and underperformance during the 1980s and 1990s but since then has grown faster than the England average. The region's economic activity rate is lower than every other English region except the North East. (Population size 2001 census = 6,729,764; Number in this study = 93,412)

Yorkshire and the Humber ranks amongst the top 20% national economies in the world. In the 1980s and 1990s the region suffered from decline in its traditional industries in coal mining, steel, engineering and textiles. However, GDP within the region grew by 12% in 2001-2007, compared to 9% on average within the UK and 6% in the EU15. (Population size 2001 census = 4,964,833; Number in this study = 69,006)

In the East Midlands, manufacturing represents 23% of output and sectors that involve a high percentage of low skilled jobs are more dominant in the region. Whilst the economy has high employment and relatively high levels of economic growth, it performs less well than the UK average on productivity. (Population size 2001 census = 4,172,174; Number in this study = 59,955)

The West Midlands has undergone significant economic changes over the last three decades with the services sector replacing manufacturing as the principal source of employment. The region contributes 8% of the UK's Gross Domestic Product. However, despite recent improvements, income per head is around 11% lower than the UK average. (Population size 2001 census = 5,267,308; Number in this study = 73,092)

The East of England has one of the highest long-term economic growth rates in the UK. The region forms part of the Greater South East (alongside London and South East England). The East of England is the most research and development-intensive region in the UK. Levels of economic growth vary across the region. (Population size 2001 census = 5,388,140; Number in this study = 78,093)

The South West is a relatively productive and wealthy region yet there are some persistent pockets of disadvantage. The region is characterised by a largely rural landscape. 81% of jobs are in the service sector. In recent years, South West England has performed relatively well within a UK economy but output per head remained 7% below the UK average. (Population size 2001 census = 4,928,434 ; Number in this study = 68,919)

London has the UK's highest productivity rate, and is the world's 4th largest economy. Employment is dominated by the financial, business and creative industries. 29% of residents are from minority ethnic groups and the region contains some areas with high levels of deprivation and worklessness (e.g. 35% of London children live in poverty - the highest proportion of any English region). (Population size 2001 census = 7,172,091 ; Number in this study = 104,872)

Table 1 Age standardised prevalence of employment and not good health by region for men and women aged 25 to 59 in 2001 Census.

	Employed	
	Men	Women
South East	89.9	75.1
North East	79.2	68.5
North West	81.8	72.0
Yorkshire and the Humber	84.1	73.5
East Midlands	86.2	73.6
West Midlands	84.7	72.9
East of England	89.4	73.8
South West	87.8	74.0
London	83.8	72.4
	Not good health	
South East	5.6	6.1
North East	11.0	10.4
North West	9.8	10.3
Yorkshire and the Humber	8.5	8.9
East Midlands	7.5	8.1
West Midlands	8.1	8.7
East of England	6.1	6.4
South West	6.8	7.1
London	7.7	8.3

Table 2 The prevalence difference in not good general health by employment for men and women aged 25 to 59 within the regions of England in 2001

Men	South East	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	South West	London
Employed	0	0	0	0	0	0	0	0	0
Unemployed	6.6 (5.2 to 8)	4.5 (2.9 to 6.2)	6.2 (5 to 7.5)	6.5 (5.1 to 7.9)	5.5 (3.9 to 7.1)	5.8 (4.5 to 7.1)	6 (4.3 to 7.6)	6.4 (4.6 to 8.1)	6.2 (5.2 to 7.3)
Retired	8 (5.9 to 10.1)	15 (10.1 to 19.9)	14.6 (11.8 to 17.3)	10.3 (7.1 to 13.5)	8.4 (5.2 to 11.6)	12.2 (8.8 to 15.5)	4 (1.7 to 6.4)	6.8 (4.3 to 9.3)	12.1 (8.9 to 15.4)
Looking after home / family	5.7 (3.2 to 8.2)	6.2 (2.6 to 9.8)	10.4 (7.7 to 13.2)	4.9 (2.3 to 7.5)	7 (3.8 to 10.2)	9.8 (6.6 to 12.9)	7.7 (4.4 to 11.1)	11.5 (7.6 to 15.3)	9.5 (6.8 to 12.3)
Permanently sick	66.5 (64.4 to 68.6)	67 (64.8 to 69.2)	66.1 (64.6 to 67.6)	67.8 (65.8 to 69.8)	68.7 (66.5 to 71)	67 (65 to 69)	68.2 (65.9 to 70.6)	65.4 (63 to 67.8)	66.3 (64.4 to 68.2)
Other	18.6 (16.1 to 21.1)	27 (22.7 to 31.3)	24.3 (21.8 to 26.8)	25.3 (22.2 to 28.4)	21 (17.8 to 24.2)	22 (19.2 to 24.8)	20.8 (17.7 to 23.9)	23.7 (20.3 to 27)	16.6 (14.7 to 18.4)
Women									
Employed	0	0	0	0	0	0	0	0	0
Unemployed	3.9 (2.4 to 5.5)	3.1 (1 to 5.2)	4.3 (2.7 to 5.8)	4.6 (2.8 to 6.3)	5.1 (3.2 to 7.1)	5.9 (4.1 to 7.7)	5 (3.2 to 6.8)	7.3 (5.1 to 9.4)	4 (2.8 to 5.3)
Retired	4.4 (2.6 to 6.3)	7.1 (3.4 to 10.9)	7.6 (5.3 to 9.9)	6.6 (4.1 to 9.2)	4.7 (2.1 to 7.3)	9.3 (6.5 to 12.2)	7 (4.5 to 9.4)	5.4 (3.2 to 7.6)	8 (5.2 to 10.8)
Looking after home / family	2 (1.5 to 2.5)	4 (3 to 5.1)	4 (3.3 to 4.7)	4.1 (3.3 to 4.9)	3.8 (3 to 4.6)	4.5 (3.7 to 5.2)	2.4 (1.9 to 3)	3.3 (2.6 to 4)	3 (2.4 to 3.6)
Permanently sick	63.6 (61.4 to 65.8)	61.7 (59.2 to 64.1)	66.1 (64.5 to 67.6)	66.9 (64.9 to 68.9)	66.2 (63.9 to 68.6)	68 (66 to 70)	65.3 (62.9 to 67.8)	63.8 (61.3 to 66.2)	65.9 (64 to 67.9)
Other	12.5 (10.6 to 14.4)	14.8 (11.7 to 17.9)	21 (18.9 to 23.1)	15.5 (13.1 to 17.9)	14.8 (12.1 to 17.4)	13.5 (11.3 to 15.6)	12.3 (10.1 to 14.5)	16.2 (13.7 to 18.8)	13.4 (11.8 to 15)

Table 3 The educational gradient (prevalence difference) in general health for men aged 25 to 59 within the regions of England in 2001

	Age adjusted	Plus employment	% reduction
South East	8.0 (7.3 to 8.7)	2.6 (2.0 to 3.2)	67.5
North East	17.4 (15.7 to 19.1) +++	2.5 (1.2 to 3.8)	85.6
North West	14.6 (13.6 to 15.6) +++	2.4 (1.6 to 3.2)	83.6
Yorkshire and the Humber	12.5 (11.4 to 13.5) +++	3.1 (2.2 to 4.0)	75.2
East Midlands	11.1 (10.0 to 12.3) +++	2.8 (1.9 to 3.7)	74.8
West Midlands	10.7 (9.6 to 11.7) +++	2.2 (1.3 to 3.0)	79.4
East of England	9.0 (8.1 to 9.9)	3.0 (2.2 to 3.7)	66.7
South West	9.2 (8.2 to 10.3)	2.8 (2.0 to 3.7)	69.6
London	11.6 (10.7 to 12.4) +++	3.6 (2.9 to 4.3)+	69

+++ = significantly ($p < 0.001$) higher than the South East's gradient
+ = significantly ($p < 0.05$) higher than the South East's gradient

Table 4 The educational gradient (prevalence difference) in general health prevalence for women aged 25 to 59 within the regions of England in 2001

	Age adjusted	Plus employment	% reduction
South East	7.0 (6.2 to 7.7)	2.7 (2.1 to 3.4)	61.4
North East	9.8 (8.0 to 11.5)++	0.3 (-1.2 to 1.7) --	96.9
North West	12.6 (11.5 to 13.6)+++	1.7 (0.8 to 2.5)	86.5
Yorkshire and the Humber	10.0 (8.9 to 11.1)+++	1.8 (0.9 to 2.8)	82
East Midlands	9.1 (7.9 to 10.3)++	2.4 (1.4 to 3.4)	73.6
West Midlands	9.5 (8.4 to 10.6)+++	2.0 (1.0 to 2.9)	78.9
East of England	6.9 (6.0 to 7.9)	2.2 (1.4 to 3.0)	68.1
South West	6.6 (5.6 to 7.7)	2.0 (1.1 to 2.9)	69.7
London	10.2 (9.3 to 11.0)+++	4.0 (3.2 to 4.7)+	60.8

+++ = significantly ($p < 0.001$) higher than the South East's gradient
++ = significantly ($p < 0.01$) higher than the South East's gradient
+ = significantly ($p < 0.05$) higher than the South East's gradient
-- = significantly ($p < 0.01$) lower than the South East's gradient

Table 5 The educational gradient (prevalence difference) in general health for men and women aged 25 to 44 and 45 to 59 within the regions of England in 2001

Men Under 45	**South East**	**North East**	**North West**	**Yorkshire and the Humber**	**East Midlands**	**West Midlands**	**East of England**	**South West**	**London**
Age adjusted	5.3 (4.5 to 6.0)	11.3 (9.4 to 13.1) +++	9.5 (8.5 to 10.6) +++	6.7 (5.5 to 7.9) +	7.5 (6.3 to 8.7) ++	6.7 (5.5 to 7.8) +	6.0 (5.0 to 7.0)	6.3 (5.2 to 7.4)	8.4 (7.5 to 9.2) +++
Plus employment	1.6 (0.9 to 2.2)	1.3 (-0.1 to 2.8)	1.2 (0.4 to 2.1)	1.3 (0.3 to 2.2)	1.5 (0.5 to 2.5)	1.0 (0.0 to 1.9)	1.7 (0.9 to 2.5)	2.0 (1.0 to 2.9)	2.9 (2.2 to 3.6)++
Reduction %	69.8	88.5	87.4	80.6	80.0	85.1	71.7	68.3	65.5
45 or over men									
Unadjusted	11.4 (10.2 to 12.7)	24.7 (21.7 to 27.7)+++	20.7 (18.9 to 22.5)+++	20.0 (18.0 to 22.0)+++	15.6 (13.6 to 17.6)++	15.9 (14.0 to 17.7)+++	12.7 (11.1 to 14.3)	12.5 (10.7 to 14.3)	17.5 (15.7 to 19.3)+++
Plus employment	4.0 (2.9 to 5.0)	3.8 (1.4 to 6.1)	4.1 (2.6 to 5.5)	5.4 (3.8 to 6.9)	4.6 (3.0 to 6.1)	3.8 (2.3 to 5.3)	4.4 (3.1 to 5.7)	3.7 (2.2 to 5.2)	4.9 (3.5 to 6.4)
Reduction %	64.9	84.6	80.2	73.0	70.5	76.1	65.4	70.4	72.0
Women under 45									
Age adjusted	5.0 (4.2 to 5.8)	6.4 (4.7 to 8.2)	7.2 (6.1 to 8.3)++	5.9 (4.7 to 7.1)	5.5 (4.3 to 6.8)	5.7 (4.5 to 6.8)	4.2 (3.3 to 5.2)	4.9 (3.7 to 6.0)	8.2 (7.3 to 9.1)+++
Plus employment	2.3 (1.6 to 3.0)	-0.1 (-1.6 to 1.4)--	0.7 (-0.2 to 1.6)--	0.8 (-0.2 to 1.9)-	0.7 (-0.4 to 1.8)-	1.3 (0.3 to 2.3)	1.7 (0.8 to 2.6)	1.7 (0.7 to 2.7)	3.9 (3.1 to 4.7)++
Reduction %	54.0	100	90.3	86.4	87.3	77.2	59.5	65.3	52.4
45 or over women									
Unadjusted	9.3 (8.0 to 10.7)	14.2 (11.1 to 17.3)++	19.3 (17.4 to 21.1)+++	15.2 (13.2 to 17.2)+++	13.4 (11.4 to 15.4)++	14.6 (12.6 to 16.6)+++	10.3 (8.7 to 11.9)	8.7 (7.0 to 10.4)	13.4 (11.6 to 15.2)+++
Plus employment	3.0 (1.9 to 4.1)	0.7 (-1.9 to 3.3)	3.0 (1.5 to 4.5)	2.9 (1.3 to 4.6)	4.4 (2.7 to 6.1)	2.8 (1.2 to 4.4)	2.7 (1.3 to 4.1)	2.4 (0.9 to 3.9)	3.7 (2.2 to 5.2)
Reduction %	67.7	95.1	84.5	80.9	67.2	80.8	73.8	72.4	72.4

+++ = significantly ($p < 0.001$) higher than the South East's gradient
++ = significantly ($p < 0.01$) higher than the South East's gradient
+ = significantly ($p < 0.05$) higher than the South East's gradient
-- = significantly ($p < 0.01$) lower than the South East's gradient
- = significantly ($p < 0.05$) lower than the South East's gradient

Supplemental table 1 Age standardised rates of employment for 25 to 59 years in the regions of England in 2001 by education.

Men	Level 4/5	Level 3	Level 2	Level 1	Other	None
South East	93.2	91.9	90.8	90.8	89.1	80.8
North East	90.9	84.6	83.9	82.5	78.1	62.7
North West	90.2	87.4	85.4	84.5	80.6	66.8
Yorkshire and the Humber	91.5	87.9	87.4	87.6	83.5	71.7
East Midlands	91.5	91.1	88.7	89.5	85.5	74.5
West Midlands	91.2	88.0	88.1	88.2	84.0	73.1
East of England	93.4	92.0	90.6	90.9	89.5	80.0
South West	91.7	90.0	89.8	89.3	85.8	78.0
London	90.1	85.7	85.3	84.3	81.4	69.2

Women	Level 4/5	Level 3	Level 2	Level 1	Other	None
South East	82.1	78.1	77.6	74.3	71.8	59.7
North East	82.5	80.4	75.6	71.0	63.3	49.4
North West	84.2	81.9	77.5	72.9	66.4	52.6
Yorkshire and the Humber	85.4	83.2	78.3	75.4	71.7	56.2
East Midlands	84.7	81.1	78.3	73.7	70.3	57.5
West Midlands	83.6	81.1	78.3	74.3	71.1	56.3
East of England	83.2	80.3	76.9	72.5	70.3	59.1
South West	80.8	79.9	76.7	73.1	68.8	59.5
London	81.5	75.2	73.7	70.0	66.4	51.8

Supplemental table 2 Age standardised rates of not good health for 25 to 59 years in the regions of England in 2001 by education.

Men	Level 4 / 5	Level 3	Level 2	Level 1	Other	None
South East	3.3	3.9	4.5	5.0	7.2	10.0
North East	5.1	7.7	7.8	8.6	12.0	18.6
North West	4.9	7.6	7.4	8.0	10.2	16.7
Yorkshire and the Humber	4.3	5.8	6.7	6.5	9.2	13.8
East Midlands	4.2	5.3	5.7	5.5	8.4	12.9
West Midlands	4.8	6.5	5.7	6.2	8.4	12.9
East of England	3.4	4.4	4.6	5.3	7.0	11.0
South West	3.9	5.6	5.6	5.7	8.3	12.2
London	4.2	6.3	6.5	7.6	8.9	14.1

Women	Level 4 / 5	Level 3	Level 2	Level 1	Other	None
South East	4.1	5.2	5.1	5.6	7.4	10.6
North East	7.7	8.0	8.9	7.4	10.7	15.3
North West	6.2	8.0	8.2	8.4	10.6	16.1
Yorkshire and the Humber	5.6	6.1	7.8	7.5	8.6	13.2
East Midlands	5.3	6.5	6.2	7.2	9.2	12.0
West Midlands	5.8	6.0	7.2	7.1	9.3	12.8
East of England	4.3	4.2	5.4	5.9	7.6	9.8
South West	5.3	5.0	6.4	6.3	7.8	10.8
London	5.3	6.6	7.5	8.3	11.0	13.7

Supplemental table 3 Differences in the prevalence of not good health by education for men aged 25 to 59 within the regions of England in 2001

	South East			**North East**			**North West**		
	Age adjusted	Plus employment	% reduction	Age adjusted	Plus employment	% reduction	Age adjusted	Plus employment	% reduction
Level 4/5	0	0		0	0		0	0	
Level 3	0.6 (0.0 to 1.3)	0.2 (-0.4 to 0.7)	66.7	2.5 (0.8 to 4.3)	0.4 (-1.0 to 1.8)	84.0	2.6 (1.6 to 3.6)	1.5 (0.7 to 2.4)	42.3
Level 2	1.3 (0.8 to 1.8)	0.5 (0.1 to 0.9)	61.5	2.9 (1.8 to 4.1)	0.5 (-0.5 to 1.6)	82.8	2.6 (2.0 to 3.3)	1.0 (0.4 to 1.6)	61.5
Level 1	1.8 (1.3 to 2.3)	0.7 (0.3 to 1.1)	61.1	3.7 (2.6 to 4.9)	0.8 (-0.2 to 1.7)	78.4	3.0 (2.3 to 3.6)	0.6 (0.1 to 1.2)	80.0
Other	4.2 (3.3 to 5.0)	2.0 (1.3 to 2.7)	52.4	6.7 (5.0 to 8.5)	1.6 (0.3 to 3.0)	76.1	5.0 (3.9 to 6.0)	1.3 (0.5 to 2.2)	74.0
None	7.3 (6.6 to 8.0)	2.1 (1.5 to 2.7)	71.2	14.5 (13.1 to 15.9)	2.0 (0.8 to 3.1)	86.2	12.5 (11.6 to 13.3)	2.3 (1.6 to 3.0)	81.6
	Yorkshire and the Humber			**East Midlands**			**West Midlands**		
Level 4/5	0	0		0	0		0	0	
Level 3	1.6 (0.5 to 2.7)	0.7 (-0.2 to 1.6)	56.3	1.3 (0.2 to 2.4)	0.9 (-0.2 to 1.9)	30.8	1.7 (0.6 to 2.8)	0.7 (-0.3 to 1.7)	58.8
Level 2	2.4 (1.6 to 3.1)	1.0 (0.3 to 1.7)	58.3	1.5 (0.8 to 2.2)	0.5 (-0.2 to 1.1)	66.7	0.9 (0.2 to 1.7)	0.1 (-0.6 to 0.7)	88.9
Level 1	2.3 (1.6 to 3.1)	0.7 (0.1 to 1.4)	69.6	1.5 (0.8 to 2.2)	0.5 (-0.1 to 1.1)	66.7	1.5 (0.8 to 2.2)	0.4 (-0.2 to 1.0)	73.3
Other	4.4 (3.3 to 5.5)	1.8 (0.9 to 2.7)	59.1	4.2 (3.0 to 5.3)	1.8 (0.8 to 2.7)	57.1	3.4 (2.3 to 4.4)	1.1 (0.2 to 2.0)	67.6
None	10.4 (9.5 to 11.3)	2.6 (1.9 to 3.3)	75.0	9.3 (8.4 to 10.3)	2.3 (1.6 to 3.1)	75.3	8.6 (7.8 to 9.4)	1.7 (1.0 to 2.4)	80.2
	East of England			**South West**			**London**		
Level 4/5	0	0		0	0		0	0	
Level 3	1.1 (0.3 to 2.0)	0.5 (-0.2 to 1.3)	54.5	1.7 (0.7 to 2.7)	0.9 (0.1 to 1.8)	47.1	1.7 (1.0 to 2.4)	0.7 (0.1 to 1.4)	58.8
Level 2	1.3 (0.7 to 1.9)	0.6 (0.0 to 1.2)	53.8	1.8 (1.1 to 2.5)	1.0 (0.4 to 1.6)	44.4	2.2 (1.6 to 2.8)	1.1 (0.6 to 1.6)	50.0
Level 1	1.8 (1.2 to 2.4)	0.8 (0.3 to 1.3)	55.6	1.7 (1.1 to 2.4)	0.6 (0.0 to 1.2)	64.7	3.1 (2.5 to 3.7)	1.3 (0.7 to 1.8)	58.1
Other	3.5 (2.6 to 4.4)	1.7 (0.9 to 2.5)	51.4	4.5 (3.4 to 5.6)	1.9 (1.0 to 2.9)	57.8	4.4 (3.4 to 5.4)	1.7 (0.9 to 2.6)	61.4
None	8.1 (7.3 to 8.9)	2.5 (1.9 to 3.2)	69.1	8.7 (7.7 to 9.6)	2.7 (1.9 to 3.5)	69.0	10.1 (9.3 to 10.9)	2.9 (2.3 to 3.6)	71.3

Supplemental table 4. Differences in the prevalence of not good health by education for women aged 25 to 59 within the regions of England in 2001

	South East			**North East**			**North West**		
	Age adjusted	Plus employment	% reduction	Age adjusted	Plus employment	% reduction	Age adjusted	Plus employment	% reduction
Level 4/5	0	0		0	0		0	0	
Level 3	1.0 (0.3 to 1.7)	0.8 (0.1 to 1.4)	20	0.6 (-1.2 to 2.4)	0.3 (-1.3 to 1.8)	50	2.0 (1.0 to 3.1)	1.2 (0.3 to 2.1)	40
Level 2	1.1 (0.6 to 1.5)	0.8 (0.3 to 1.2)	27.3	1.2 (0.0 to 2.5)	0.3 (-0.8 to 1.3)	75.0	2.1 (1.4 to 2.8)	0.6 (0.0 to 1.2)	71.4
Level 1	1.5 (1.0 to 2.0)	0.8 (0.3 to 1.2)	46.7	0.1 (-1.1 to 1.3)	-1.5 (-2.5 to –0.5)	100.0	2.2 (1.5 to 3.0)	0.0 (-0.6 to 0.6)	100.0
Other	3.2 (2.1 to 4.3)	1.9 (1.0 to 2.9)	40.6	2.7 (0.4 to 4.9)	-0.3 (-2.2 to 1.6)	100.0	4.3 (2.9 to 5.7)	0.7 (-0.5 to 1.9)	83.7
None	6.7 (6.0 to 7.4)	2.6 (2.0 to 3.2)	61.2	8.1 (6.7 to 9.6)	0.7 (-0.5 to 1.9)	91.4	10.8 (9.9 to 11.6)	1.8 (1.1 to 2.5)	83.3
	Yorkshire and the Humber			**East Midlands**			**West Midlands**		
Level 4/5	0	0		0	0		0	0	
Level 3	0.7 (-0.5 to 1.8)	0.4 (-0.6 to 1.4)	42.9	1.2 (0.0 to 2.4)	0.9 (-0.1 to 2.0)	25.0	0.5 (-0.6 to 1.6)	0.1 (-0.9 to 1.0)	80.0
Level 2	2.1 (1.3 to 2.9)	0.9 (0.2 to 1.6)	57.1	1.1 (0.3 to 1.9)	0.6 (-0.2 to 1.3)	45.5	1.6 (0.8 to 2.4)	0.9 (0.2 to 1.6)	43.8
Level 1	2.0 (1.2 to 2.8)	0.4 (-0.3 to 1.1)	80.0	1.9 (1.1 to 2.7)	0.6 (-0.2 to 1.3)	68.4	1.4 (0.6 to 2.1)	0.2 (-0.5 to 0.9)	85.7
Other	2.9 (1.5 to 4.3)	0.7 (-0.5 to 1.9)	75.9	2.9 (1.4 to 4.5)	1.6 (0.2 to 2.9)	44.8	2.7 (1.2 to 4.2)	0.6 (-0.6 to 1.9)	77.8
None	8.3 (7.3 to 9.2)	1.7 (0.9 to 2.5)	79.5	7.5 (6.5 to 8.4)	2.1 (1.2 to 2.9)	72.0	7.9 (7.0 to 8.8)	1.8 (1.1 to 2.6)	77.2
	East of England			**South West**			**London**		
Level 4/5	0	0		0	0		0	0	
Level 3	0.1 (-0.8 to 0.9)	-0.2 (-1.0 to 0.6)	100.0	-0.3 (-1.3 to 0.7)	-0.1 (-1.0 to 0.7)	-	1.4 (0.6 to 2.2)	0.9 (0.2 to 1.6)	35.7
Level 2	1.1 (0.4 to 1.7)	0.4 (-0.1 to 1.0)	63.6	1.1 (0.4 to 1.8)	0.6 (0.0 to 1.3)	45.5	2.2 (1.6 to 2.8)	1.2 (0.7 to 1.8)	45.5
Level 1	1.6 (1.0 to 2.3)	0.6 (0.0 to 1.2)	62.5	1.2 (0.5 to 1.9)	0.3 (-0.3 to 1.0)	75.0	2.9 (2.3 to 3.6)	1.2 (0.6 to 1.8)	58.6
Other	2.5 (1.3 to 3.8)	0.8 (-0.4 to 1.9)	68.0	3.0 (1.5 to 4.5)	1.0 (-0.2 to 2.3)	66.7	5.4 (4.1 to 6.8)	2.9 (1.7 to 4.1)	46.3
None	6.1 (5.3 to 6.9)	1.9 (1.2 to 2.6)	68.9	6.0 (5.0 to 6.9)	1.9 (1.1 to 2.7)	68.3	8.9 (8.1 to 9.7)	3.3 (2.6 to 4.0)	62.9

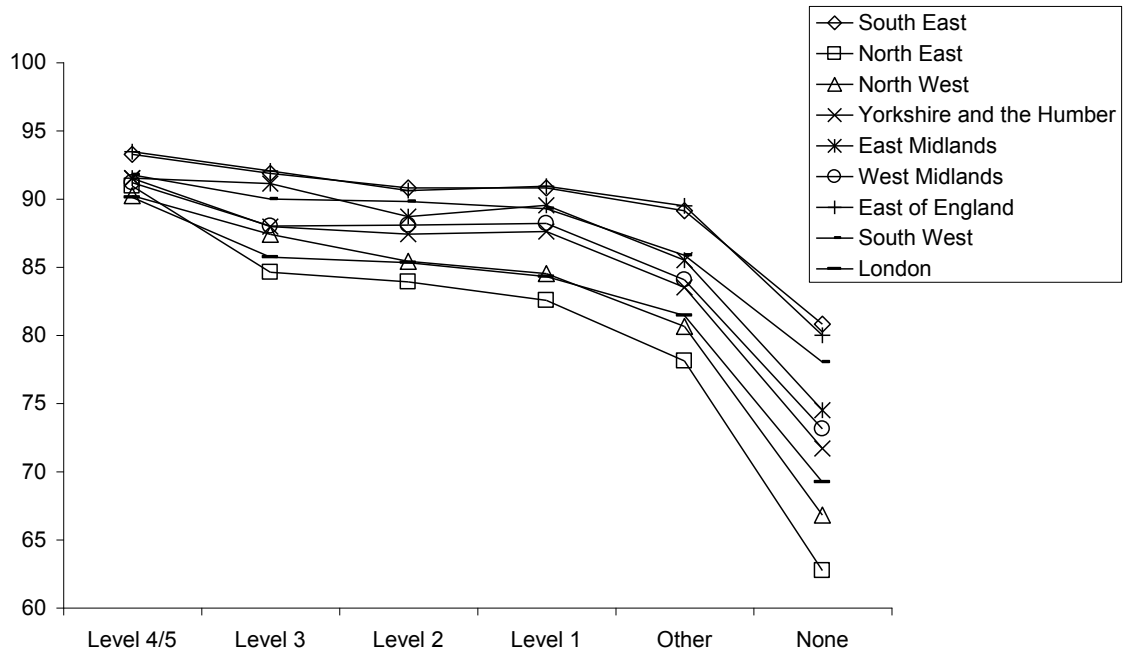

Figure 1 Age standardised rates of employment for men aged 25 to 59 years within the regions of England in 2001 by education.

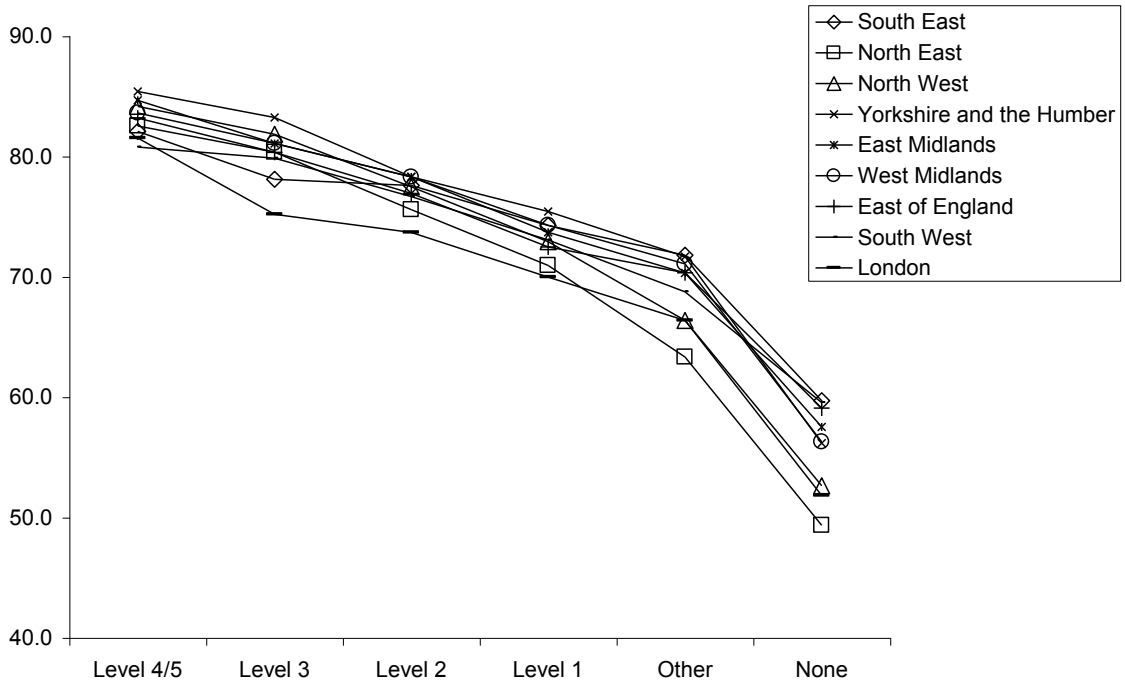

Figure 2 Age standardised rates of employment for women aged 25 to 59 years within the regions of England in 2001 by education.

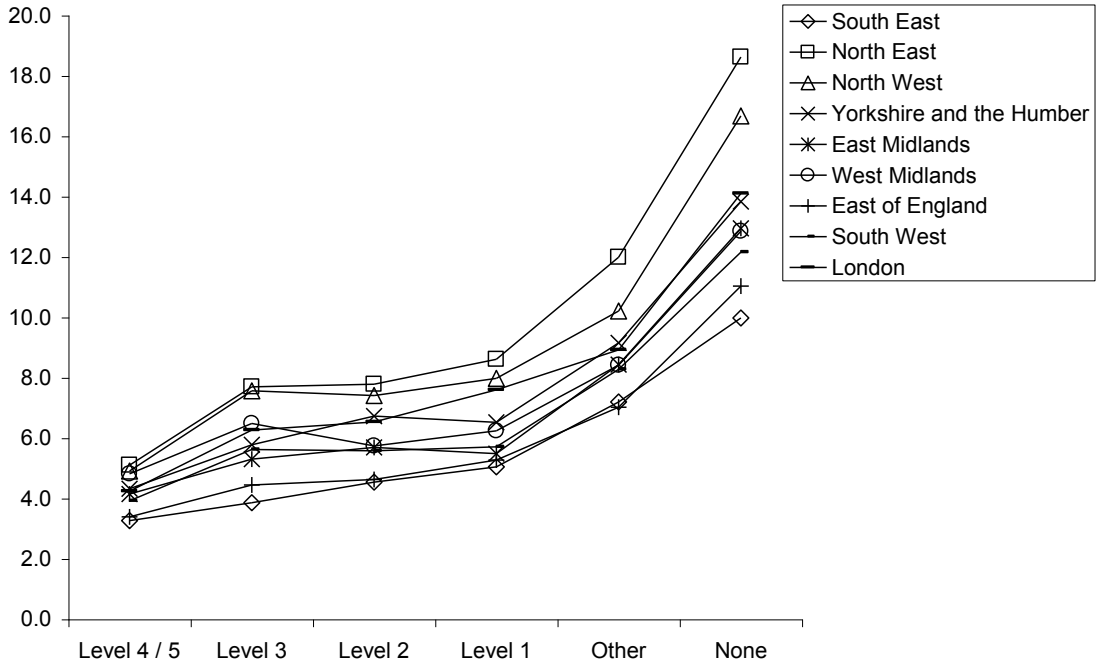

Figure 3 Age standardised rates of not good health for men aged 25 to 59 years within the regions of England in 2001 by education.

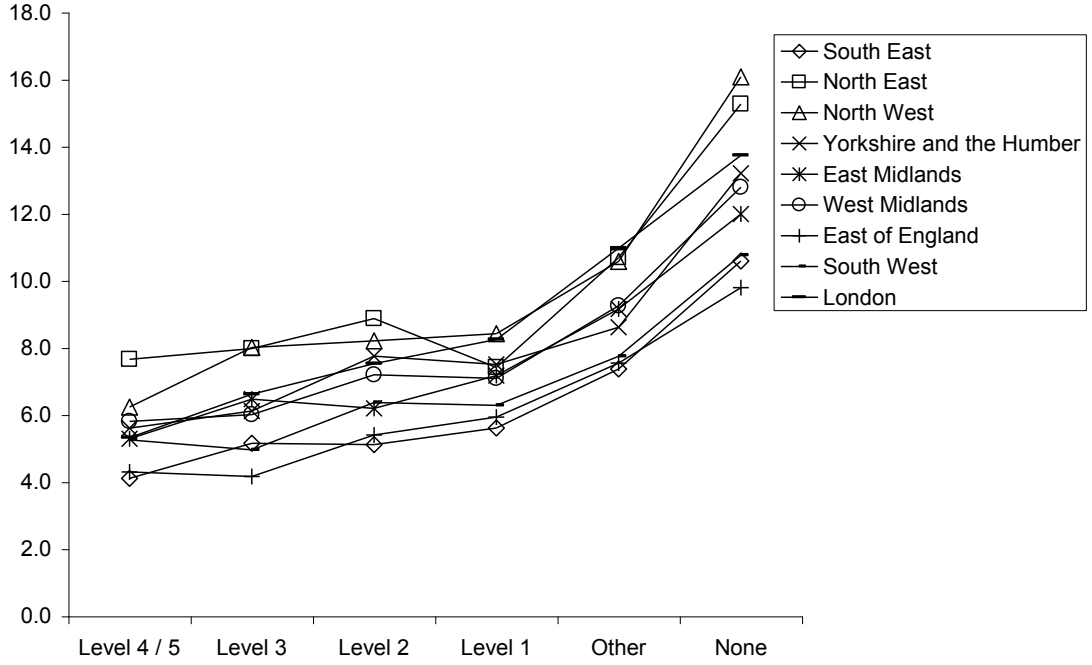

Figure 4 Age standardised rates of not good health for women aged 25 to 59 years within the regions of England in 2001 by education.